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ABSTRACT

This paper reviews the psychological theories and research which deal with the meaning of words in the course of human psychological development. The three major premises of the review are: (1) that word meaning is conducive to empirical study, (2) that rules can be produced that apply to most word meanings, and (3) that human development has implications for the qualities shared by human word meanings. Four psychological approaches to word meaning are identified, discussed, and compared: behaviorist, signal-systems, cognitive, and linguistic. The various theories and empirical research findings which support each approach are examined in detail; common elements are summarized. Implications for research are suggested, and implications for early education (prereading), later education (including reading), and testing are considered for each approach. (Author/ED)

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WORD MEANING IN HUMAN DEVELOPMENT

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Abstract

Psychological theories and research concerning word meanings and their place in human development were reviewed. Four psychological approaches to word meaning were distinguished and elaborated upon: behaviorist, signal-systems, cognitive and linguistic. After each appraoch was described, its implications for work meaning in human development were explored. After all four approaches were presented, they were compared, and similarities among them were pointed out. Implications for research were suggested, and implications for education were considered, the latter divided into early education (pre-reading), later education (including reading), and testing.

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WORD MEANING IN HUMAN DEVELOPMENT

The following pages are concerned with the meaning of words in the course of human psychological development. The worth and manageability of this undertaking as presented here require the acceptance of serveral premises.

The first is that word meaning resides in actual individuals and is conducive to study by empirical methods. Some have argued that human error and limitation so distort the underlying structure of linguistic and other symbolic meaning that the study of meaning is best left to philosophical and linguistic logicians; and it cannot be denied that cautious argument is essential to worthwhile talk about meaning. It may also be contended that the empirical study of meaning has frequently become sidetracked by issues not central to meaning or that meaning itself was considered a side issue. Creelman (1966) has reviewed a large number of studies in which this appears to be the case. Theories and data have had a difficult time meeting in this area. But unless they meet, they are both of questionable value. Language and symbols are primarily the products of the human species. If the logic of a pure language did not account for these products, what would it in fact account for? To avoid belaboring the point, let it simply be said that it seems easier to accept the psychological nature of linguistics than to justify the historical distinction between psychology and linguistics.

The second premise here is that rules can be produced which apply to nearly all instances of word meaning. Katz & Fodor (1963) cite the impossibility of producing general rules as the biggest drawback to the formulation of a semantic theory. This conflict is a perennial problem of theory-building, and it would seem that the general response of a theorist to the problem is most applicable. Guthrie (1959) has asserted that it is the

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simplicity of men that makes rules desirable, not the simplicity of nature. In this case, rules about word meaning are produced because men are seeking to understand rules of word meaning. To prejudge the impossibility of this venture is simply to choose not to participate in it.

The third premise of this review is that human development has implications for the meanings of words. The development of word meaning may be considered quantitatively or qualitatively. Quantitative development of word meanings refers simply to the addition and accumulation of words and their meanings over the course of time. A case will be made here that the development of word meanings includes qualitative changes as well. The qualities involved are somewhat dependent on the approach and will be further specified below. The assertion here is that the qualities shared by all or most word meanings change during life, that certain qualities are shared by young children and somewhat different qualities by adults.

Thus the three major premises upon which this review rests are: (a) that word meaning is conducive to empirical study; (b) that rules can be produced that apply to most word meanings; and (c) that human development has implications for the qualities shared by human word meanings.

Approaches

Four psychological approaches to word meaning may profitably be distinguished: behaviorist, signal-systems, cognitive, and linguistic. That is not to say that each approach is entirely unified; nor is it to say that the approaches are mutually exclusive. These approaches are each accepted within some academic community which shares certain premises and in some cases uses a distinctive language.

The behaviorist premise of greatest importance here is that all human activities

--words and their meanings included--are best described in terms of stimuli and responses. There is further a predilection towards the observability and measurability of stimuli and responses. If unobservable contructs are used, they are primarily to explain observable phenomena. Proponents of this approach are mostly American. Among them are Skinner, Bousfield, Osgood, Noble, Staats, Mowrer, and the developmentalist Kendlers.

The signal-systems approach seeks a neuropsychological explanation of meaning. Based largely on the work of Pavlov (1966), three levels of neural activity are postulated. The lowest level is that of unconditioned reflexes, which include the orienting reflex upon which higher systems are based. The next system or level is called the first signal system; this system deals with direct, sensory and perceptual data and is possessed by all animals. The highest level is the second signal system, which deals with verbal and symbolic data and is most elaborated in humans. Proponents of the signal-systems approach are those most influenced by Pavlov; the majority of them are Russian. They include Vygotsky and Luria.

The major cognitive premise is that unobservable cognitive or mental structures with their own rules are responsible for human dealings with reality, both direct and symbolic. This approach is probably the most unpredictable of the four approaches because it is not firmly tied to anything observable--neither behavior, physiological reflexes, nor language. The choice of words in a cognitive theory can make it, on the one extreme, inclusive of practically any approach or, on the other, an indefensible straw man, easily explained away. Diverse theorists may be seen as representing the cognitive approach to word meaning: Lenneberg, Olson, Riegel, and others; and those concerned with cognitive development: Piaget and those inspired by him, Werner and Kaplan, and Anglin.

The linguistic approach is meant to include those psychologists who have embraced the generative transformational grammar given great impetus by Chomsky. There

is of course much more to linguistics than Chomsky's contributions; but the vast history of that discipline before Chomsky has had comparatively little influence on psychology. The general premise of a linguistic approach is that the study of word meaning is a part of the study of language; and that the study of language is sufficient to explain word meaning. The relationship between syntax and semantics, that is, between structures of words and their meanings, is seen as a central problem in transformational grammar. Those who apply this approach to psychology include--along with Chomsky--Katz, Fodor, McNeill, and Herbert and Eve Clark.

On the following pages, the behaviorist, signal-systems, cognitive, and linguistic approaches to word meaning will be more elaborately explored. The various theories in each approach and contentions among them will be examined, along with the findings of empirical research on these matters. Following each approach will be the implications and research supportive of that approach concerning general changes in word meaning in the course of human development. Finally, the common elements of the approaches will be summarized; and implications will be derived for the conduct of inquiry, next research steps, and educational practices.

The Behaviorist Approach

The behaviorist considers language to be a phenomenon of human behavior which can be explained by a general theory of the behavior of organisms, with little or no modification of the theory. There is, or at least was, a split among behavioral theorists about word meaning. Single-stage theorists have maintained that meaning is redundant mentalistic baggage which detracts from the parsimony of a scientific account of words. Mediational theorists have held that it is necessary to postulate meaning as a construct intervening between stimulus and response.

Single-stage Theories

Skinner (1957) asserted the redundancy of talk about word meaning in his book Verbal Behavior. Although meaning in its ordinary sense proves useful in clarification ("What do you mean?"), Skinner claims that this ordinary sense of meaning does nothing to scientifically account for verbal behavior. A scientific account of verbal behavior involves the identification of stimuli "which have an acceptable scientific status and which, with luck, will be susceptible to measurement and manipulation [p. 10]." Scientific meaning is thus a property of the conditions under which behavior occurs.

Skinner divides behavior involving words into two types: the mand and the tact. A mand is a verbal response which is characteristically followed by certain consequences ("Shut the door!"). Traditionally, the meaning of a mand would be the reinforcing consequences which follow it. But the scientific account of a mand concentrates rather on the stimuli which control it (the aversive stimulus from the hall, for instance). Hence, according to Skinner, an attempt to specify the word meanings of a mand simply clouds the scientific issues at stake.

The tact is explained by Skinner as a three-term contingency--a stimulus leads to a response which is reinforced. For example, in the presence of a dog a young child is praised for saying "dog." Skinner defines a tact as "a verbal operant in which a response of given form is evoked (or at least strengthened) by a particular object or event or property of an object or event [pp. 82-83]." This definition seems more troublesome than the simple three-term contingency, because it appears to confound stimulus with reinforcement. Thus, critics (Chomsky, 1959; Fodor, 1965) could easily assert that the frequency of objects or properties rather obviously does not correspond to the frequency of the tacts which represent them. If Skinner had slightly modified his statements about correspondence between stimulus

and reinforcement, his case would have been more difficult to dismiss on this point. His discussion about properties and abstraction permits just this sort of leeway, because what a tact refers to is contingent upon which perceptual and memory responses tend to be reinforced. For this reason a tact is never totally under the control of objective stimuli, but is also under the control of perceptual and memory responses. The danger of such an argument, from Skinner's viewpoint, is that such responses are not readily observable or manipulable.

The general argument that Skinner makes is that meaning, when taken as an unobservable intervening construct, is an unnecessary complication of phenomena that can be explained wholly by observable stimuli and responses within a scientific context. The emphasis is not so much on a denial of the subjective experience of meaning as it is on a denial of the scientific worth of this experience.

Bousfield (1961) carries single-stage theory further by identifying word meaning with associative verbal responses. Such an assertion, however, takes on the problems of syntax and structure in language as well as the problems of semantics and reference. While the relationship of syntax to semantics is a complex one, it seems best to suggest here that the single-stage explanation of word meaning is more readily acceptable than a single-stage explanation of linguistic structure. Linguistic explanations of linguistic structure (see below) in fact seem ultimately more parsimonious than the tedious complications introduced by a single-stage explanation.

Perhaps the problem can be clarified by the notion of semantic size. Meaning is attributed to several linguistic units varying in size: the morpheme (defined as the smallest meaningful linguistic unit), the word, the sentence, and perhaps (with written language) paragraphs, chapters, and books. Semantic size appears to have a direct

relationship with complexity of structure. There is little discussion about the structure of a morpheme. Concern about syntax and structure increases as semantic size increases. This concern expresses itself in linguistics by semantic feature or semantic component analysis of morphemes and syntactic analysis of sentences. It is not dealt with in such detail with units of larger semantic size; but any scientific author realizes that the successful expression of larger units of meaning requires their structuring at larger levels, as well as at the more discrete ones systematized in linguistics.

The semantic size of words is relatively, though not completely, undisturbed by this problem of structure. It therefore seems possible to further consider Bousfield's identification of word meaning with associative responses without considering its further implications for problems of syntax.

Bousfield's case rests on the experimental and clinical paradigm of free association. A word is offered as a stimulus to which a subject responds with other words. These other words, Bousfield claims, are the meaning of the stimulus word for that subject. To identify associated words as meaning has two difficulties. First, it ignores the variety of relationships that can exist between two-words--they may simply sound alike or have opposite meanings or the association may simply be a trivial orephemeral one. Second, such a method does not allow for the relationship between a word and an extralingual object. Bousfield's formulation makes language a closed system which can be described independently of perception and sensation.

Mediational Theories

Alternatives to the single-stage stimulus-response view of word meaning are the mediational theories in most cases derived from the theory of Hull (1943). Among them are the earlier work of Osgood (1952), and the work of Noble (1952), Staats (1961), and

Mowrer (1960).

Osgood (1952) rejected the mentalistic view of Ogden & Richards (1923), in which meaning or thought is seen as the unobservable connection between a referent and the symbol which stands for it. He further rejected the substitution view of Watson (1916) in which a word is seen as the conditioned stimulus which evokes the same response as the unconditioned stimulus which it signifies. He pointed out that in fact the response elicited is not the same in Watson's two cases. Instead he proposed a representational mediation process. Retaining the conditioning paradigm, he maintained that the word, acting as a conditioned stimulus, elicits some reduced portion of the total response to the word's referent: r_m. He further theorized that the minimal response r_m produces self-stimulation s_m; and that both r_m and s_m are amenable to measurement, primarily physiological--such as action potentials in the striate muscles, salivary reactions, and the galvanic skin response.

Osgood has also made a valuable distinction between signs, which are directly associated with objects or events, and assigns, which are associated rather with other signs.

Osgood has collaborated on another major contribution to the study of word meaning with the development of the semantic differential technique (Osgood, Suci, & Tannenbaum, 1957). In a sense, the technique is a refinement of the free association technique. A word is presented as a stimulus and the subject is asked to rate the stimulus word on a number of seven-point bi-polar scales bounded by polar adjectives (for example, heavy-light, good-bad, beautiful-ugly). Three response factors repeatedly manifest themselves when the various polar adjectives are factor-analyzed: evaluation (good-bad), potency (potent-impotent), and activity (active-passive). As with free association, it is questionable whether the semantic differential deals with word meaning in the strict sense.

However, it may deal with a type of connotational meaning that is indicative of the way people tend to see the world.

Noble (1952) focused on Hull's notion of habit strength as the meaning variable mediating between stimulus and response. A stimulus is associated with a given response according to the habit postulated between them. In Noble's theory, meaningfulness is defined as the number of habits subsisting between a stimulus and its several responses taken together. This method of course easily applies to the free association paradigm. To repeat, when meaning is inferred solely from response words, it seems both linguistically too diverse and extralinguistically too limited. But the method has one clear advantage to a behaviorist--it is measurable. Noble obtained associative verbal responses to 96 stimulus words from 131 subjects. Applying statistical techniques based on the definition above, he obtained inter-rater reliabilities on word meaningfulness of .97 and higher.

Staats (1961) again made use of Hull's notion of a habit-family, but gave a more elaborate explanation of meaning. A stimulus, when firmly associated with an effective response, also becomes associated with an anticipatory response which is a minimal fraction of the higher-energy effective response. This fractional anticipatory goal response, r_g, has stimulative properties which evoke the anticipation of a hierarchy of potential responses, the strongest of which in turn stimulates the effective goal response. The fractional anticipatory responses are in some cases word meanings.

Mowrer (1960) also defined meaning as a mediating response, that is, as a part of the total response to a thing which a word by association has the capacity to evoke. Mowrer's analysis of the sentence as a conditioning device is of particular interest. Most people assume that it is the function of language to transfer meanings from one person to another. But this is not so. A person transfers meanings from one sign to another within

himself, then by communication arouses similar transfers of meaning within another person. Thus, a part of the response to the predicate of the sentence becomes evoked by the subject of the sentence. To cite Mowrer's example--"Tom is a thief"-- part of one's response to "thief" becomes evoked by "Tom."

The behaviorist explanations of word meaning may presently be silent, but they are not dead. Behaviorism's contributions and criticisms of certain aspects of language should remain a vital challenge to other theorists.

Development

The theorists described above, as well as the majority of behaviorists, attempt to describe phenomena which are identical or similar in all living organisms. In the case of word meaning, they would insist that their explanations apply equally to the two-year-old child who has just acquired his first words and the erudite author with an extensive and complex vocabulary.

A notable exception to this view is the work of Kendler and his associates (especially Kendler, Kendler, & Wells, 1960; Kendler, 1963). It is his desire to extend, rather than attack, the behaviorist approach by identifying age differences which happen to have strong implications for word meaning.

Single-stage and mediational behaviorist theories may be contrasted as those which deny that variables or constructs intervene between stimuli and overt responses and those which postulate mediating responses between stimuli and overt responses. Kendler and others (1960) hypothesized that younger children's "verbal responses, though available, do not readily mediate between external stimuli and overt responses [p. 87];" whereas older children are more likely to employ verbal responses as mediators. These verbal responses may be seen as word meanings.

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Kendler has developed a procedural paradigm which permits subjects a choice between what are called a reversal shift and a nonreversal shift. In the nonreversal shift, subjects choose objects on the basis of similarity to a stimulus. In the reversal shift, subjects choose objects which represent the opposite of a stimulus within the same dimension. One may infer that the reversal shift requires the use of a cognitive structure or word meaning for the dimension to mediate between the original stimulus and its opposite.

Kendler (1963) ran such an experiment with children aged 3, 4, 6, 8, and 10. The predicted developmental trend was supported: the proportion of those who used the reversal shift (indicating mediation) rose with age from 36% to 60%; those using the nonreversal shift went from 20% to 25%; and those who were inconsistent in their use of shifts decreased with age from 42% to 10%. Kendler proposed on the basis of this data a three-stage hierarchy of development. At stage one, there is no covert response mediating between a stimulus and an overt response. At stage two, that of nonreversal, there are covert verbal responses, but they do not consistently mediate between stimuli and responses, but rather they sometimes interfere with them. At the third stage, covert verbal responses consistently mediate between stimuli and responses. The correspondence between these stages and ages at which they are manifest is made complex both by differential rates of development and the limitations of non-longitudinal research. But the transition from the single-stage direct associations between stimuli and responses to verbal mediations would seem to occur for many children between the ages of 5 and 7 years.

The Signal-systems Approach

Cross-cultural study of the development of psychology in America and Russia illuminates certain social and political influences on the development of the discipline. By subserving their individual interests to the state, Russians have achieved a more

programmatic thrust to their study of psychology that, for better or worse, maintains the emphases of early pioneers such as Pavlov and Sechenov. For a similar reason, the social responsibility of Russian psychologists is more evident than it is among many American psychologists.

A striking aspect of Russian psychology is that it is seen as an extension of physiology. Pavlov was a physiologist. Human behavior is seen as a function of higher cortical systems, just as blood circulation is seen as a function of the cardiovascular system. Partly because of this, Russian psychologists have a tendency to use small sample sizes and to ignore statistical presentation of data. Their work thus tends to appear more theoretical than American studies. Russian work tends to be either explanatory or demonstrative of a theory. There is an emphasized attitude about empiricism and the avoidance of mentalism; but in practice large generalizations are made from few subjects.

The basic Pavlovian theory undergirding the signal-systems approach is that there are three levels of energy in the central nervous system which correspond to three levels of complexity of function. The lowest energy level is that of unconditioned reflexes. These are physiological behaviors possessed by an organism and are not dependent on learning. Among these reflexes is the orienting reflex, by which organisms enact the reception of sensations. The orienting reflex is thus the basis for more complex cortical systems. The first signal system possesses a middle level of neural energy and takes up where orienting reflexes end. It processes the sensations which result from the direct experience of things. According to Ivanov-Smolensky (1956), there are two types of activities involving words in the first signal system. One is the transfer of neural energy from an object to a word, from a stimulus to a verbal response. A second activity is the transfer of neural energy from a behavior to a word, from a response (verbal or nonverbal) to a verbal

response. The second signal system possesses the highest level of neural energy and is unique to the larger-brained mammals--humans, and perhaps chimpanzees and dolphins. It deals with indirect experience and knowledge. According to Ivanov-Smolensky, the words with direct referents of objects or behavior and which are classified in the first signal system may be associated with a dynamic transmission of neural energy to more abstract words in the second signal system. Put another way, the first signal system includes words which correspond to various sensations, but organized in a prelogical way. The second signal system is formed from the data of the first by the processes of verbal substitution and concept formation.

The status of words in the first signal system is unclear. Bridger (1960) seems to indicate that the system consists of primary conditioned responses "such as sensations, perceptions, and direct impressions of the environment [p. 425]." But, as mentioned above, Ivanov-Smolensky (1956) would also include in the first signal system the words associated with these sensations. The point is crucial to an explanation of word meaning in the signal-systems approach. In the former case, word meaning resides in the relationship of the first signal system (sensations) to the second signal system (words). In the latter case, there are two types of word meaning: one composed of sensory data, one composed of other words. The former case emphasizes meaning as extralingual reference; the latter emphasizes the distinctness of abstract words from direct-referent (concrete) words.

Vygotsky (1962) has been called the architect of the second signal system. It is his work that expands Pavlovian behavior theory to the point that it appears cognitive. But it is perhaps best to explain Russian work in its own terms, rather than attempt a superficial and premature translation into other approaches. It is significant that Vygotsky's book, Thought and Language, first published in 1934, was suppressed for 20 years; he

refused to accept the easy answers of either materialism or mentalism. Categorization of his work as one or the other of these betrays the struggle of the author.

Vygotsky claimed that the traditional division of sound and meaning in words destroys the basic inter-functional relations of verbal thought. He asserted that word meaning is the unit of minimal analysis. He also claimed that a word is a generalization referring to a group or class of objects. Thus a word meaning is a generalization, or a concept, and word meaning is a phenomenon of thinking.

Thinking is generalizations or concepts can follow one of two courses in mature humans, according to Vygotsky. One course is that generalizations be transformed into word meanings which form the subtext for communicative speech. In the other course, verbal thought takes the form of inner speech, a specific kind of speech with its own rules. One rule is that the sense of a word in inner speech, that is, all the psychological events aroused by a word, has predominance over meaning, the most stable zone of sense. (This differentiation of sense and meaning, attributed to Paulhan, seems to clarify associative theories of meaning by reclassifying them as theories of sense). Another rule for inner speech is that both words and senses of words combine and flow together, words influencing words and senses influencing senses by simple contiguity of occurence.

There is some ambiguity in Vygotsky's presentation. It is clear that inner speech and communicative speech are different. What is unclear is the number and description of variables which differentially occasion these forms of speech. This ambiguity is excusable however, given the age of the work and the fact that it was cut short by the author's untimely death.

A body of research on semantic conditioning and generalization shall be reviewed here. Although the notion of stimulus generalization is shared with the behaviorist

approach, much of the work using words as stimuli has been carried out in the Soviet Union. More importantly, the theorization upon which this method is based fits readily into the signal-systems approach. Semantic conditioning consists of the simultaneous presentation of an unconditioned stimulus and a word or sentence. By repeated pairings, the unconditioned response comes to be elicited by the word or sentence. Generalization is simply the spread of the elicitation of the same response to other words, sentences, or objects which have some similarity to the originally conditioned word or sentence. Razran (1961) and Creelman (1966) have reviewed a number of Russian studies in which a variety of reflexes have thus been conditioned to words--among them, saliva secretion, vasoconstriction, and a reduction in the time of blood coagulation. (This latter is particularly surprising because blood coagulation is not ordinarily considered a function of cortical processes.) However, there is no statistical treatment of the data, so the results are somewhat suspect to an American audience. Riess (1940) was one of the first Americans to use the semantic conditioning technique, employing the galvanic skin response (GSR) as the response to be conditioned. A buzzer (eliciting a heightened GSR) was paired with 4 stimulus words out of 50 until the GSR of 26 subjects for these words was three times normal. Then the GSRs to words similar to the stimulus words in either sound or meaning (homonyms or synonyms) were measured. It was found that greater GSRs were evoked by the synonyms than by the homonyms. Apparently, meaning evokes measurable "symptoms." This gave rise to the developmental studies described below.

This technique and such findings buttress the physiological leanings of the signal-systems approach. Words, which are associated with hypothesized levels of neural energy, are shown to influence the observable phenomena of lower levels of neural energy.

Development

The straightforward implication of signal systems for human development is that they develop in order of energy and complexity: first the unconditioned reflexes, then the first signal system, and finally the second signal system. However this assertion seems never to have been so simply made. Theorists usually deal with more complex issues. Vygotsky and Luria have both made contributions within this area. Luria's work on semantic conditioning is accompanied here by a description of similar American work.

Vygotsky (1962) can be fully understood only as a developmentalist. He saw the essence of psychic development as change in the interfunctional structure of consciousness, that is, in the complex intra-relationships of verbal thought. Thought and speech are neither the same phenomenon nor distinct phenomena; in the course of development they are separate or together in varying degrees. The second and first signal systems stand in this same juxtaposition. Needless to say, it is inevitable that such a premise leads to apparent obscurities in Vygotsky's theoretical presentation.

According to Vygotsky, thought and speech progress at different rates. Largely independent of each other before the age of two years, at two years their relationship becomes much stronger and speech goes from an affective-conative function to a primarily intellectual function. At this point, word meaning follows the course of concept development. Vygotsky studied 300 subjects of all ages by what he called the method of double stimulation, in which are presented both objects of activity and signs which serve to organize the activity. He inferred three levels in the development of concepts (word meanings) differentiated into approximately 11 stages of development.

At the first level, children group objects into unorganized heaps, in which inherently unrelated objects are linked by chance. This level has also been called the

level of syncretism. There are three stages within this level.

The second level occurs when children think in complexes: that is, objects are grouped by tangible, factual bonds. The five sequential types of complexes are: associations, collections (complementary objects), chains (series of associations), diffuse complexes (with a fluid attribute), and pseudo-concepts (with a common attribute arrived at by chance). Pseudo-concepts are most common in a five-or six-year-old child.

Vygotsky's third level of development involves concepts, objects united by a single attribute, derived by a demonstrable process of abstraction. There are three slightly different stages of concepts.

The key dimension of development here is the ability to group or generalize. The products of these groupings--be they heaps, complexes, or concepts- are word meanings. Hence there is a distinction between the meaning and the referent of a word: "the victor at Jena" and "the loser at Waterloo" have different meanings, but Napoleon is the referent for both.

Vygotsky also discussed the changes in proportion of the appearances and meanings of speech. The externals of speech are at first words; then they become sentences--the progression is from parts to whole. Meanings, alternatively, go from the wholes of situations to their analysis into ever finer parts.

Another of Vygotsky's points is that in development grammar precedes logic: language regularities are learned arbitrarily before the ability to generate rules develops. (There is a bit of an anomaly here. The ability to generate grammatical rules is typically inferred from the very use of language regularities.)

Vygotsky contrasted his approach to speech development to Piaget's with regard to egocentrism. Vygotsky interpreted Piaget (1923) as positing two stages in the develop-

ment of the social function of speech--first it is egocentric, then it becomes socialized. Vygotsky saw egocentric speech as developing into inner speech at about the time that another function of speech became operational--communicative speech. Vygotsky presented a series of studies to verify his version of development--he showed that children's egocentric speech decreases when they are with non-speakers or alone or when there is much background noise. It is difficult to see how this finding has anything to do with the difference between the theories of Piaget and Vygotsky. It would seem that the fact was established that there are social supports for egocentric speech; this is expectable in either theory.

Nevertheless, the implications of Vygotsky's theory for the development of word meaning should be considered. Egocentric speech and inner speech differ from communicative speech ordinarily in the dominance of sense over meaning. Vygotsky thus stresses the constancy of sense through development and the qualitative addition of meaning, the stable zone of sense, with development of the communicative function of speech.

Luria is a student of Vygotsky who has made large contributions to the study of word meaning in human development in his own right. Luria's work may be divided into two areas: (a) semantic conditioning and generalization and (b) verbal regulation of behavior. The first of these can be seen as transmission within the second signal system of reflexes conditioned into the first signal system. The latter can be seen as the transmission of second-signal-system word meanings into behaviors.

Luria is only one of a number of students of semantic conditioning in development. Riess (1946) did the classic developmental study, employing four groups of subjects aged 7 through 20 years. The conditioned response generalized most strongly from stimulus

words to their homonyms in the youngest subjects (7;0 to 8;9). In the next youngest group (10;0 to 11;8), antonyms were strongest, followed by homonyms. In the two oldest groups (13;5 to 14;10 and 17;2 to 20;1), synonyms were strongest. Riess characterized the direction of word generalization as moving from similarity in sound to similarity in meaning; that is, word meanings become more salient in the course of human development.

Luria & Vinograda (1959) studied semantic conditioning and generalization in children ages 11 to 15. They envisioned semantic systems in which the key words were surrounded by systems of words with "sense-links," then non-reactive words outside each system, some of which may sound like the key word. They found that a generalization went through two stages, first extending to all words within a system, then becoming more discriminate and concentrated on the key word's meaning. The semantic system for a word was therefore divided into nucleus words (the key word and words directly related) and peripheral words, related only by sense. The conditioned response in this study was vasoconstriction; after the treatment subjects could not reliably report the bases for generalization of the response. This suggested that the second-signal semantic systems are physiologically connected to the first signal system and more stable then introspection or self-report would indicate.

Felzen & Anisfield (1970) obtained results similar to those of semantic conditioning studies by a different method. They compared children aged 8 to 9 years with children aged 10 to 12 years on the following task. A number of five-word clusters were presented, each cluster containing a key word, its synonym or antonym, a word similar in sound to the key word, and control words for these latter two. Then subjects were presented with a list of 121 words and asked whether each word was "old" (previously presented) or "new." When words not previously presented were classed as old words, it was called

false recognition. Children aged 8 to 9 falsely recognized a significant number of words that sounded like key words, but did not make false recognitions on the basis of semantic similarity (synonyms or antonyms). Children aged 10 to 12 made false recognitions on the basis of both similar sound and similar meaning. Word meanings again appear more salient to older children.

Luria has also studied the verbal regulation of behavior (Luria, 1959, 1960; Luria & Yudovich, 1959). He defines the regulative function of language as its potential coordination, stabilization, and facilitation of other forms of behavior. Luria seemingly identifies the development of verbal regulation as the principal mechanism in the internalization of social conduct.

Pulling Luria's statements together, the following age and stage patterns emerge. In the first stage, the infant cannot respond to language; hence verbal regulation plays no role in the direction of behavior. The second stage is transitional: verbal regulation plays a partial role in behavior. When the child aged 1 year or so begins to respond to speech at all, he can initiate behavior in obedience to the speech of another person, but cannot stop or reverse ongoing behavior because of verbal instructions. This is so because the second signal system is still weaker than the orienting reflex and the factor of inertia. The child even at the age of 2 or 3 years who can follow the directions of another is still unable to say words that direct his own behavior. Finally, at the age of 5 or 6 years, the capacity for inner speech has developed, and the child can obey the functioning of his second signal system.

The notion of verbal regulation of behavior is an intriguing one, with extensive psychological and educational implications. In fact, the entire educational enterprise, insofar as it attempts to influence behavior by verbal instruction, rests on the assumption

that words can and do influence behavior. But Luria's work deals only with the capacity of words to regulate behavior in early childhood not with the actual regulation of behavior by words as it might occur past the age of 6 years. The question is whether it is the way that this capacity was formed that most influences a given instance of the potential verbal regulation of behavior or whether proximal circumstances are more influential. Put another way, the question is whether there is a trait or characteristic relationship between an individual's reception or emission of speech and his behavior. Luria has not dealt with this more crucial and more difficult question. It is a potentially fruitful area for future research.

The Cognitive Approach

Crucial to a psychological theory is the question of what constitutes evidence for a given statement. Can oneaccept the validity of private events, accessible only to the one who experiences them? And if the events themselves are accepted, how far can one go in specifying their nature and the rules which they follow? It might be said that behavior which is not accessible to everyone is not scientifically acceptable. But, in dealing with word meaning, if words are accessible and referents are accessible, is word meaning then accessible? Maltzman (1968) considers the answers to these questions to be a matter of choice; and, pending further resolution of the issue, it is clear that certain psychological theorists have chosen to infer statements about human activity that are not reducible to simple behavior, measured physiological correlates, or the constraints of language.

Almost no contemporary scientist accepts the philosophical doctrine of absolute dualism. Dualism is the doctrine that there are two independent kinds of existence--matter and spirit, physical reality and mental reality. The doctrine arose among the Greeks and was kept viable through the times during which Europe was under the sway of religious absolutism. As the advances of science began to challenge relgious dogmas,

dualism asserted itself--the domain of science was physical reality; spirit and mind were the domain of philosophy and theology.

But now many feel a need for a reallignment. The methods of science have proven extremely successful in acquisition and use of knowledge about physical reality; why not modify them and apply them to mental reality as well? But, while people no longer find matter and mind completely independent, few (except perhaps behaviorists) can accept their complete identity either. Vygotsky for one struggled mightily with this problem. Others who have dealt with it are here classified as taking a cognitive approach to word meaning. (Linguists and psycholinguists following Chomsky also take a cognitive approach; they appear in the next section.)

The classic work of Ogden & Richards (1923) made a case for the necessity of thought or reference as a mediator between symbol and referent. According to them, a symbol symbolizes a thought or reference which refers to a referent. Sometimes this triadic relationship is abbreviated to say that a symbol stands for a referent, but there is no linear relationship between a symbol and a referent.

It is not easy to group cognitive theories or to be certain where they agree and disagree. They are clearly in disagreement, however, with those who would reduce word meanings to simple stimulus-response associations. One grouping, however, would include the work of Piaget, Werner, and Anglin; this work cannot be extricated from its developmental context, while the work immediately following can be.

Lenneberg (1967) made a key distinction between concept formation and the naming or labeling of concepts. He considered the attachment of words to certain types of concept formations to be a peculiarity which distinguishes humans from other animals. All vertebrates, according to Lenneberg, engage in the process of categorization which is

composed of (a) differentiation or discrimination of categories and (b) transformations by which categories are interrelated. Concept formation is the primary cognitive process; naming, the tagging of conceptual processes, is a secondary cognitive process.

Some concept-formation processes have sensory input. These particular processes are suited to scientific study because sensory input can be ordered by objective criteria which are measurable. This is the maximum control that can be exerted over the processes which lead to words (barring direct physiological manipulation). Lenneberg has used an instrument called a color solid for such sensory input. Hues change with space at measurable intervals, and the determinacy with which a word is used to name a given space can be ascertained.

Lenneberg has used the color space to validate his hypothesis that words are subordinate to concept-formation processes. He has found that words only mildly bias such processes. For instance, persons whose language has more names for a given color space are not able to make more acute determinations within that space. However, these studies, while supportive of Lenneberg's position, are by no means definitive.

Olson (1970) also asserted the primacy of cognitive processes. He devoted somewhat more effort than Lenneberg to the separation of meaning from the narrow confines of semantics within linguistics into which Chomsky (1965) placed it. Linguists have concentrated on problems of the relations among words rather than on problems of reference, the relations between words and objects or events. Chomsky maintained that grammar is primary because meaning is not assigned until a sentence is parsed. But Olson asserted that "the choice of words in an utterance is a function of neither syntactic nor semantic selection restrictions, narrowly defined, but of the speaker's knowledge of referents [p. 258]." In fact, Olson reasserted the Ogden & Richards formula (1923) with a further

specification about reference: a sign symbolizes the experience of perceiving referents in a context.

Olson's cognitive theory of semantics rests on four postulates. The first is that words do not name things and things do not have names. There is not a one-to-one correspondence between a word and a thing; rather, there are many words for one thing and many things for one word. The second postulate is that words do not name intended referents, except relative to the set of alternatives from which a referent must be differentiated. Olson defines "information" as any perceptual or linguistic cue that reduces the number of alternatives to the intended referent. This seems to be a broadened cognitive notion of the linguistic selection restrictions. The third postulate is that an utterance does not exhaust the potential features of the perceived referent, but rather keys in on those features of a referent that distinguish it from potential alternatives. The fourth postulate is that a word or an utterance, in specifying both referent and excluded alternatives, contains more information than the simple perception of a referent; this is the advantage of words over direct perceptions of their referents. By these four postulates, Olson carves out a unique cognitive function for words--simply put, words delineate perceived referents.

Olson distinguished himself from behaviorist mediational theorists who consider the meaning of a word to be a response event; he considers word meaning to be a perceptual, discriminative event. Now it can be said that perception is what turns a physical stimulus into a functional stimulus. But to therefore consider perception a stimulus event rather than a response event seems somewhat arbitrary. A discrete Hullian analysis could categorize perception either way. Olson's concentration upon the delineation of perception, however, is a major contribution to theorization on word meaning.

Riegel (1970) has developed a well-organized relational interpretation of

language acquisition. He maintained that elements (phonemes, objects, etc.) are not as important in language as are various relations between and among them. There are two classes of relations: intralingual and extralingual. Intralingual relations equate words--verbal definitions would be examples. There are three kinds of extralingual relations: ostensive--pointing, "That is a zebra."; intensive--the imperative, Skinner's mand, "Go away!"; and expressive--the exclamatory, "Ouch!". Including both intra- and extra-lingual relations, there are three organizational classes: logical--synonymy, subordination, etc.; physical--part-whole, location, etc.; and grammatical--lexical case, word position in a sentence, etc. Riegel found that the ability to use these organizational relations in guessing words related to cue words increased gradually to a peak at 12 years of age.

Gibson (1971) asserted that word meanings reflect cognitive processes. She emphasizes particularly the perceptual learnings which precede semantic features, the components of word meanings. Perceptual learning is organized around distinctive features, invariants, and the economical structuring of both. When some thing or event is perceived as invariant and distinct from the multiplicity of information perceived, it may become a semantic feature of a word or words. In general, invariant actions or states differentiated from the environment become verbs; masses or things that can be counted and which have fixed borders or shapes become nouns.

Roger Brown (1958b) has elaborated somewhat on a referential theory of word meaning. He summarized psychological debate of earlier years as being the question of whether word meanings are brightly colored mental images, available through introspection (Titchener, 1909) or subtle motor habits in the larynx (Watson, 1916). Introspection has been rejected (or at least modified) as a valid psychological method; and Watson's motor habits have not been reliably associated with thought that does not become speech. So

Brown (and also Slobin, 1971) settled upon a cognitive explanation of word meaning. He defined linguistic reference (word meaning) as "the coordinate recurrence of categories, one a linguistic form and the other not [p. 9]." A category is a grouping of objects and events.

Brown's definition brings up a point about theorists classified here as cognitive. Some, like Gibson and Olson, are clearly talking about internal processes that are not visible. Others, like Brown, Piaget, and Werner talk about internal processes, but divide their research into linguistic and sensorimotor areas. A grouping can apply to words and/or things; it is this emphasis on grouping that makes these men cognitivists. Cognitive rules are not necessarily unobservable to them; they are rules which apply to two classes of observable events--words and objects.

Ausubel (1966) has developed a theory based properly on cognitive content which emphasizes individual differences. For him, meaning in words or other events is but potential meaning for a listener. The actual meaning a listener infers from such events is the subsumption of their cognitive information into his pre-existing cognitive structures. Misunderstanding occurs when a speaker's cognitive structures differ from the cognitive structures which a listener considers pertinent to an utterance. While, as Olson (1970) suggested, words are less open to ambiguity than the perception of their referents, Ausubel pointed out that words can still be ambiguous because of differences in meanings attached to them.

Osgood (1971) appears to have abandoned the behaviorist-cognitive dilemma in his more recent writing and expanded his explanation of meaning unequivocally into the cognitive area. The stimulus/response dichotomy is of little use in analyzing meaning, he suggests, because meaning takes on response-like functions in language reception and

stimulus-like functions in language emission. Also, the similarities between linguistic and sensorimotor behavior have helped convince Osgood of the value of a cognitive approach to word meaning.

First, there is the observation that pre-linguistic sensorimotor behavior displays many characteristics of linguistic behavior--perceptual signs have meanings and they are structured. Secondly, it is possible to translate sensorimotor and linguistic behaviors from one medium to the other. These facts suggested for Osgood a cognitive system common to both sensorimotor and linguistic behaviors.

Osgood asked the question whether the generative grammar notion of deep structure (explained below) is sufficient to account for the origin of sentences. Osgood defined the antecedent of a sentence as "a momentary cognitive state which is not linguistic at all but yet has its own semantic structure [p. 519]." Semantic structure so defined is equivalent to cognitive structure. Osgood continued in this vein to devalue the importance of syntax relative to semantics. He suggested that syntactic transformations of the semantic structure are in fact secondary operations that do not account for much in the production of sentences. Perhaps behaviorism has not explained linguistic performance, but, according to Osgood, neither has generative grammar.

Development

Some interesting early work of Lewis (1937) presaged both cognitive and linguistic approaches to word meaning. He saw development as the freeing of language from dominance by the immediate situation. Language at first either accompanies or initiates acts and only gradually becomes free from the present situation both spatially and temporally. Thus older children surpass younger children in referring to absent events or past and future events. Lewis (1951) repeated these ideas and added the concept of

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initial affective responses to intonation by young children. These develop from affective responses into acts of reference to objects upon the hearing of words. This hypothesis was extended by Macnamara (1972) to include comprehension as well as language production. He suggested that the infant initially determines the speaker's intended meanings independently of the speaker's linguistic utterances. He supported his hypothesis by citing examples of syntactic and phonetic ambiguities which could not be understood by syntax or phonetics alone without reference to meaning, and which are in fact understood by children. However, his examples are not quite to the point in that they are linguistic, and his hypothesis depends on first understanding meanings intended independently of language. However, it would seem most difficult to operationalize "intended meanings." At the same time, Macnamara's proof by elimination of non-semantic alternatives reminds one of Chomsky's early definition of semantics as "everything left over."

Jean Piaget has been the principal architect of contempory cognitive-developmental psychology. He has written prolifically on a wide range of topics over the past half-century. But, owing to his own development as well as a certain turgidity in his early writing (partly due to translations), his theorization pertinent to word meaning in human development must be gleaned almost inferentially from a number of his works. One may also rely on those who have worked with or interpreted Piaget, like Sinclair-de-Zwart and Berlyne. But they bring their own background to bear so strongly on their interpretations that one inevitably gets involved in the game of asking what Piaget really said. This presentation will strive for accuracy as well as integration.

Piaget first addressed the phenomenon of language in his book The Language and Thought of the Child (1926). His question in this work was a novel one and explains why the work is somewhat tangential to the problems of work meaning covered in these

pages: he wanted to know what needs a child tends to satisfy when he talks; that is, what are the psychological functions of children's speech. This is perhaps not a surprising question for a psychologist to ask. In fact, it is strikingly similar to Skinner's (1957) pursuit of a scientific account of verbal behavior in the conditions under which such behavior occurs.

Egocentric speech, according to Piaget, is spontaneous speech which is non-communicative or non-discursive; that is, an impartial observer would not judge it to be directed towards another person or persons. (Piaget later [Piaget, 1962; Piaget & Inhelder, 1966] clarified the point that the child thinks he is talking to others and making himself understood, but that this intention of the child is not readily observable.) According to Piaget, 45% of the spontaneous speech of children aged 4 to 8 years is egocentric. Such speech may occur when the child is alone; or, when he is with other children, a phenomenon called collective monologue may occur, in which children are talking, but are not successfully addressing each other. Egocentric speech is a kind of verbal syncretism. In addition to being nondiscursive, verbal syncretism is intuitive rather than deductive and has the quality of conviction with no evidence necessary.

Piaget (1959, 1962) disagreed with Vygotsky and Luria that egocentric speech facilitates a child's adaptation and is a prelude to inner speech. Rather he claimed that egocentric speech occurs precisely because the child has not yet developed certain means of adaptation and therefore indicates a failure to adapt. However, the difference in the two theories on this point has yet to be stated in such a way that it may be subjected to empirical test by presently available methods.

Egocentrism is central to Piaget's overall theory and as such demanded some explanation here. But, as previously stated, egocentrism is not, strictly speaking, a part

of a theory of word meaning. Rather, it may be seen as antecedent to word meaning, in that it suggests the motives for word meanings acquired and used.

Piaget subsumes language activities under what he calls the semiotic or symbolic function. His first major book on this subject was La formation du symbole chez l'enfant (1945). Language ordinarily comprises a large portion of the symbols and signs dealt with by the semiotic function. But the semiotic function begins with an infant's imitation of sounds and movements--activities far removed from the use of word meanings by adults.

When a child is born, he responds to stimuli, if at all, in a reflex manner. After several months he begins to imitate first his own sounds and movements (repetition) and eventually the movements of models other than himself. At the age of 1;4 or 1;5, he becomes capable of deferred imitation--copying a movement several hours after he has observed it. For imitation to be deferred, it must be interiorized; interiorized imitation is mental representation.

Mental representation is the broad sense is thought, conceptual representation. In the specific sense, representation refers to images and other semiotic instruments. Representation is in part the result of the cognitive process of accommodation, by which thought and images are fit to reality. Accommodation is complemented by the cognitive process of assimilation, in which reality is filtered through already existing cognitive structuring. Assimilation becomes evident as representations are reenacted in play. Eventually, the successfully adaptive, mature human is able to balance accommodation and assimilation by the process of equilibration.

Verbal signs (meaningful words) emerge in the child just as representations come into use. Some representations correspond to word meanings; some do not, because no words are associated with them. Language aids cognitive development by extending

an individual's range of experience, by introducing representations otherwise unavailable. But Piaget, as Lenneberg, considers words themselves--that is, phonetic or graphemic expressions--to be no more than convenient tags or labels for cognitive representations.

Piaget (1966) distinguished between the index and the signal, both of which may occur without cognitive representation. An index is a signifier which is a part or aspect of its significate or which is causally linked to its significate (for example, the tracks of an animal in the snow). A signal is a partial aspect of the event that it heralds; a classically conditioned stimulus (a bell when food is presented) is a signal in this sense. Another class of signifiers require representation--symbols and signs. In both of these there is a differentiation between signifier and significate. In a symbol, signifier and significate still maintain some degree of similarity. A sign is arbitrary and based on convention; it need retain no similarity whatsoever with its significate.

In sum, Piaget presents the semiotic function as developing from reflex through imitation to representation. He sees word meanings as a usually large subset of a person's representations. But sensory and movement experiences may also be represented, so language is not the only form of the semiotic function.

Sinclair-de-Zwart (1969) has been specifically concerned with language from a Piagetian viewpoint. Her concern has focused on whether language or thought is responsible for the other. She has found strong support for the primacy of thought in the finding that blind children (a salient sensorimotor deficiency) tend to be 4 years behind normal children and deaf-mutes (a salient language deficiency) in the development of logical operations. Thus, sensorimotor deprivation retards the development of logical thought more so than does language deprivation. If this is so, language (at least the range of language permitted by the ability to speak and hear) need not play a major role

in the development of logical thought. The issue acquires its importance in that if logic depended entirely on the acquisition of language, it could be considered a cultural artifact of relative value. But if logic develops independently of language acquisition, as appears to be the case, it may be considered universal and not dependent on culture.

Berlyne (1954, 1957, 1966) has persistently attempted to find common ground between Piaget's theory and behaviorism, particularly in what he calls neo-associationism. He has recast Piaget's description of development as a series of stages in the mediation between stimuli and responses. In a later paper (1966) he probed the foundations of Piaget's theory and behaviorism. Piaget, he claimed, has erred in characterizing behaviorism as premising the one-way reception of the external world by a passive organism. Berlyne drew attention to the position of Thorndyke and Skinner that one knows nothing if one does nothing--a response must be made (to be reinforced) to be learned. Thus, like Piaget's position, a common behaviorist position may be considered interactionist. For Piaget's part, Berlyne added, although he constantly speaks of the mind, his inferences are always firmly rooted in observations of external behavior. Berlyne concluded that the judgment of history might very well be that Piaget was an eminent neo-behaviorist--"sans le savoir et malgré lui [p. 233]." While Piaget protests Berlyne's characterization of him, Berlyne's attempt to bring theories together could prove useful in this contentious area.

A well-organized theory of symbol formation, including word meaning, has been proposed by Werner & Kaplan (1963). They introduced their work by identifying three of their major premises.

Their orientation is holistic: any local organ or activity (a word, for example) is considered to be dependent on the context, field, or whole of which it is a part (compare Gibson and Olson). This approach to psychology has had a considerable following, from

the Gestalt psychologists through Lewin. Werner's second premise is that behaviors are directed towards ends. This may seem innocuous, but such a premise has evoked great consternation among psychologists and philosophers--for how can the future be operative in the present? Werner saw tendencies in organisms both to direct their own activities and to develop naturally towards adaptive functioning. This leads to Werner's third premise--what he called the orthegenetic principle--that development follows the course of increasing differentiation and hierarchic organization.

Werner described three stages in human development. In the first stage, an infant reacts reflexively to stimuli. In the second stage, the child carries out goal-directed sensorimotor action upon signaled things. Werner's third stage is a more original contribution; he described it as the stage of contemplative knowledge about percepts and concepts. Werner saw in development a loosening of stimuli and responses, a movement towards learning and knowing. The instrumentality of learning and knowing is the symbol.

A symbol does more than simply substitute for a thing. It emerges from cognitively-oriented rather than pragmatically-oriented operations. Signs or signals anticipate, elicit, or inhibit sensorimotor actions. A symbol represents not only a denoted referent but the connotational semantic field which surrounds it. And, according to Werner & Kaplan, "The distinguishing mark of language is its function of symbolic representation [p. 17]."

Werner maintained that there is an inner similarity between a symbol and what it represents, based on the cognitive process which unites them. This confusing statement is perhaps best explained with a study by Kaden, Wapner, & Werner (1955). Subjects were to move their heads so that pictures before them were judged to be at eye level. It was found that subjects raised their eye level higher for a picture of a man with his hands down

than for a picture of a man with his hands up. This same effect was observed for words like "lowering" versus words like "climbing." Werner claimed that this generality of effects points to a similar underlying cognitive process in the perception of an object and the perception of a symbol.

The course of human development is organized well by Werner. There are four generic components of symbol situations: the addressor, the addressee or audience, the symbol or symbolic vehicle, and the object symbolized. Each of these four components undergoes change with development. In addition, pairwise combinations of them develop by the process of distancing, by growing farther apart.

The addressor changes mainly by biological maturation. The persons addressed shift with the age of the addressor: first he speaks to his parents, then his peers become more salient to him; finally he is able to address the generalized other. The objects symbolized increase in range because of the development of increasing ability to differentiate and abstract. The symbolic vehicle becomes less idiosyncratic with age and more conventional (this last was supported by the study of Werner & Kaplan, 1950).

As for the various pairwise linkages, several will be mentioned here to demonstrate the principle of distancing. The growing distance between addressor and object has presented itself through history as the conflict between the subjective and the objective. The relation between symbolic vehicle and object is at first such that the symbolic vehicle is considered part of the object. This is exemplified by belief in the magical power of certain words--that they can evoke the activities which they represent. It is also exemplified by children's belief that words cannot be assigned to new objects without a transfer of properties. For example, to call a dog a cow, he would have to have horns (and presumably an udder). As the child develops, symbols become less attached to their objects.

The addressor-addressee relationship begins with a sharing of many experiences by mother and child. As the child matures, there is a shift from shared experiences to unshared experiences which require more articulation to communicate.

This is an extremely brief summary of Werner's theory. This theory is directly focused on word meaning and its development and presents a most coherent account of it. Such a theory ought to merit more widespread consideration.

Anglin (1970) asserted that a word contains or possesses meaning and that this meaning is given largely by the sentence in which the word occurs. With this as a framework, he went on to attempt to answer what he called the crucial developmental question: whether an individual's word meanings become more abstract as he develops.

The pertinent experimental finding is the so-called syntagmatic-paradigmatic shift (McNeill, 1970). Children are asked either to say words as responses to stimulus words (Brown & Berko, 1960; Ervin, 1961) or to form clusters of words from a list (Miller, 1967). Two kinds of associations seem to emerge: syntagmatic or heterogeneous associations, in which the words associated are of different grammatical classes; and paradigmatic or homogeneous associations, in which the words associated are of the same grammatical class. Before the age of 6 years, syntagmatic associations predominate. Between the ages of 6 and 8 years, paradigmatic associations begin to become more prevalent. McNeill (1966) and Entwisle (1966) held that early so-called syntagmatic associations are actually paradigmatic, based on broad grammatical classes or semantic categories which children possess.

Anglin's question was whether children do perceive broad semantic classes at first and gradually differentiate among them--that is, go from the general to the specific. The alternative is that children first perceive similarity among small groups and later among larger classes (Vygotsky, 1962)--that is, they go from the specific to the general, from the

concrete to the abstract. The question is whether syntagmatic responses are indicative of general classes (recall Vygotsky's heaps or complexes) or simply of a lack of classes. General classes might be inferred in three ways: first, if commonalities among syntagmatic responses could be labeled with abstract words by children; second, if such commonalities could be induced by a mature judge; and third, if children themselves could sort words according to general commonalities. Anglin claimed to have found support for the specific-general developmental hypothesis by the third method, because children formed many piles of few words each rather than few piles of many words each. He made a partial case for proof by the second method as well, claiming to have found thematic principles uniting the words which children sorted into piles (see also Miller, 1967). These thematic principles however are more idiosyncratic than are those of adults; the tenuousness of these categories might well be taken as lack of support for categories at all. Thus it seems that Anglin's findings as supporting either classes or the lack of classes.

All that is clear from the syntagmatic-paradigmatic shift studies is that young children do not choose to sort words according to a certain pattern of abstract categories--parts of speech. While the weight of inference opposes it, it has not been conclusively demonstrated that young children possess no stable abstract categories or that they cannot acquire such categories. As Anglin has pointed out, it is easy to talk (abstractly) about abstract categories, and in some instances hierarchies of abstraction can be developed (see the work on semantic features below, especially Clark, 1971). But in other instances it is much less clear that hierarchies of abstraction can be developed in any but an arbitrary sense. Research on such hierarchies should strive for comprehensiveness rather than taking individual examples as illustrative of a theory.

Brown (1958a) offered an explanation for certain aspects of language that may

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profitably be applied to Anglin's developmental question - whether children go from specific to general or from general to specific. He suggested that certain words achieve high frequency of use because those words are the most useful in dealing with everyday affairs. abstract words are not very useful in the everyday affairs of the young child, so his parents do not teach him (provide opportunities for him to hear) those words. Researchers look for conventional abstract words which, it so happens, the child has not had the opportunity to learn. At the same time idiosyncratic words of the child's own invention may have a wide range of referents. For instance, the child's first words may well apply to all humans as well as food or hunger situations. If assertions are made about maturational limitations in learning or knowing, it is reasonable to expect that opportunities for the acquisition of the variables in question have been verified.

The Linguistic Approach

To appreciate the impact of current linguistic theories upon psychology, a brief review of the recent history of that discipline is useful.

The dominant trend in linguistics at the beginning of this century was the structural linguistics exemplified by Bloomfield (1933). The effort of this approach was concentrated on the taxonomization of phonetic units, discriminated at the minimal discrete level. Semantics, the meanings of sounds, was taken to include the knowledge of every item in the language user's world. Under such a strict empirical rubric, it is not surprising that structural semantics was considered an interesting but unmanageable enterprise (Maclay, 1971).

Concentration upon a rigorous phonetics to the exclusion of other aspects of linguistics set the stage for a revolutionary reformulation of theory. In 1957, such a revolution was heralded by the publication of Chomsky's Syntactic structures. The

classification of phonemes paled before the problems of generative transformational grammar. The new focus was syntax, the description of the construction of sentences: how can you, a linguist or a child, construct a grammar? In Syntactic Structures, Chomsky described meaning as "a catch-all term to include every aspect of language that we know very little about [p. 104]." At this time Chomsky's grammar had a morphophonemic rather than a semantic component. The impossible task which the structural linguists had associated with meaning was still accepted--tiny bits of phonemic-semantic data were considered the basic components of language.

Semantics was first elaborated within generative transformational grammar with Katz & Fodor's "The structure of a semantic theory" (1963). Semantics was seen to complement Chomsky's (1957) grammar in the generation of synchronic linguistic description. Grammar was to handle linguistic structure. Semantics was to handle meanings. The form of a semantic theory for Katz & Fodor sprang principally from a language user's ability to detect nonsyntactic ambiguity, anomaly, and paraphrase; the more general ability to pair sounds and context-related meanings was still considered beyond the realm of linguistic theory-building. The semantic component of language was taken to consist of two parts: a dictionary (consisting of both syntactic and semantic markers, that is, indicators of the meanings of morphemes and of their structural relations within sentences) and projection rules (finite means for relating an infinite number of sentences and meanings).

The work of Katz & Fodor (1963) had considerable influence on Chomsky's (1965) redefinition of generative transformational grammar as consisting of three components: syntactic, phonological, and semantic. The key to this formulation is that each sentence is hypothesized to have two structures: a surface structure, which corresponds precisely to its phonological representation as manifest in physical signals, and a deep structure, which

retains only what is semantically significant in the sentence, before these "basic phrases" have been acted upon by transformations. The transformation is the principal instrument of a transformational grammar; it is a "rewrite" rule that alters the form of a sentence without changing its underlying meaning. Thus the semantic component is said to interpret deep structures which do not take the manifest form of perceived sentences. (Since Chomsky focused on the sentence in his elaboration of syntax, the natural complement to this work was focus on the meanings of sentences.) Chomsky maintains that the science of linguistics is best advanced by search for insight rather than objectivity. His theory is clearly and professedly more rationalist than empirical.

The value of such an approach to the psychologist must be demonstrated. Linguistic theories were not originally assumed to be constrained by psychological processes. It is the traditional goal of linguistics to describe language and formulate descriptive rules for language without reference to the language user. Linguists not long ago took great pains to keep their discipline completely separate from psychology and other disciplines whose goal was to explain language in terms of the language user. It was partly for this reason that Chomsky stressed the distinction between linguistic competence and performance. His theory was one of linguistic competence, the use of language by an ideal speaker-listener. Linguistic performance, on the other hand, is guided by competence, but is also subject to unpredictable distortions by memory failure, confusion, mistaken beliefs, and other psychological frailties.

But more recently (1972a and b), Chomsky stressed the need for the development of both semantic and psychological theory about language. He is beginning to see linguistics as the psychology of language. This releases a host of questions that may not apply to generative transformational grammar as a purely linguistic theory, but do apply

to it as a hypothesized description of language acquisition, perception, or production.

One question involves the most useful unit of analysis of meaning in language. Bloomfield would perhaps have considered it to be the phoneme or morpheme. Current linguists of Chomsky's persuasion appear to consider it the sentence. The argument for the word as unit of analysis is that words represent the most stable components of meaning in language. Phonemes change meaning from word to word, and sentences are seldom produced more than once. A second argument is that word meanings constitute the most parsimonious building blocks of a semantic theory. The number of phonemes may be finite, but their combinations and relations with meaning are practically infinite. The number of potential sentences is infinite as well. But the number of words and word meanings is finite in reality and somewhat limited even in specuiation.

The root question for psycholinguistic theory is whether a linguistic hypothesis corresponds to a psychological operation in the human use of language. Since Chomsky is a cognitivist, the question is whether his description of grammar describes cognitive operations of a language user. That is a language producer would organize linguistic and other information into a semantic representation of a sentence, assign this representation a deep structure (by applying phrase-structure rules), then transform it to a surface structure transmitted by phonological representation. These operations could occur sequentially or simultaneously, but would always include whole sentences. A sentence could not be produced without all of its constituents having some cognitive representation beforehand. This leads to a statement like Olson's (1970) that a word is a sentence with its other constituents implicit. But one may as well say that words, not sentences, are the basic cognitive units; if a choice must be made, either position is supportable. This is a thorny theoretical problem that is not simply resolved by the

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success of syntax with sentences.

Perhaps the resolution of this problem can be found in Winograd's (1971) handling of semantics in an artificial language developed for digital computers. He did not make a choice between word and sentence meanings, but programmed the parallel processing of both plus still broader processings of general discourse and context. (One is reminded of Madame Nhu's remark about soldiers being "barbecued" which was so heavily critized. The word "barbecued" was appropriate to the meaning of the sentence, but not to discourse about human beings.) Simply stated, the processing of word meaning may be distinct from, although connected with, the processing of sentence meaning. It is at the sentence level that syntax becomes a part of semantics (Rosenberg & Jarvella, 1970; Perfetti, 1972). But sentence meanings are not the primary object of concern here.

Chomsky (1972a) has started to venture into semantic theory construction and has suggested simple sound-meaning pairings rather than more complex structures. A phonetic representation is associated with a semantic representation by grammatical and other rules. As a psychological theory, this is distinguished from other theories in that it has two unobservable terms: the semantic representations and the pairing rules. Pairing rules have the potential advantage of making a psycholinguistic semantic theory workable--semantic representations without such constraints are practically limitless; but this advantage remains potential until specific pairing rules are produced.

A related issue is the identification of semantic features of a word by abstraction. This was discussed above as part of Anglin's study (1970). It also entered into the work of the Clarks, as described below.

Language Versus Cognition

The interface between linguistics and cognitive psychology presents the expectable problem of which discipline explains more. The linguist pressed to explain human linguistic phenomena would be predisposed to see language and universal linguistic rules as the primary cognitive processes or determinants of those processes. A famous protagonist of this position in the extreme was Whorf (1956) who maintained that language decreed an individual's organization and classification of information. Most current psycholinguists propose that people develop linguistic processes completely distinct from non-linguistic cognitive processes. On the other hand, the cognitivist would maintain that there was "something more" that transcends specific linguistic data. Piaget and Sinclair-de-Zwart saw cognitive activity in both speech and sensorimotor actions. Such a belief has permitted Piaget to theorize at length about epistemology while spending relatively little time in research on language. Lenneberg (1967), who referred to the labeling of cognitive activities, has provided limited support for his position with his study of color-naming. But there is not yet definitive empirical support for the primacy of either linguistic or non-linguistic cognitive activities. McNeill (1971) argued that it is impossible to say whether the structure of thought influences the structure of language. He distinguished weak and strong linguistic universals. Both may have a necessary cause in cognition, he said, but cognition is not sufficient cause for strong linguistic universals; they are also dependent upon some purely linguistic characteristic.

The question casts a revealing light on psychological and linguistic differences in goals and methods. While the psychologist is concerned with universal cognitive abilities, he is not so concerned with possible peculiarities in his sample of humans--it is usual that 25 or so human beings are taken to represent mankind. But differences in

languages are more obvious--as exemplified in the idioms of each language. A linguist who uses examples from his native language alone is on shaky ground until parallel examples from other languages are confirmed. Thus linguists refer very carefully to linguistic universals. Psychologists are much more presumptive of the universality of what they talk about.

Development

McNeill (1970) has provided a comprehensive and unified description of language meaning in the course of human development. There are, according to McNeill, three periods in the development of word meanings. In the first period, the young child engages in the holophrastic use of words; that is, a single word has for him several sentence interpretations. As the number of his words increases, this strategy rapidly becomes unwieldy; in the second phase, each word he uses receives one sentence interpretation. For instance, "bah" might indicate that the baby is hungry and desires a bottle. The third period, according to McNeill, is the development of a word dictionary; this begins around the age of 18 months. The child is concurrently developing syntactic rules which enable him to use the words of his dictionary in sentences. The acquisition of basic syntax continues until the child is 28 to 30 months old, at which time he learns how to make syntactic transformations. The word dictionary continues to grow, both by the addition of new words and by the addition of semantic features to words already there, at least until the child is 8 years old; more likely, such acquisition is a lifelong process.

Compelling evidence for word meanings as complexes of semantic features comes from the studies of Herbert Clark (1970) and Eve Clark (1971). Herbert Clark (1970) divided semantics into concerns with surface structures of sentences, deep structures of sentences, and lexical structures which have more abstract semantic relations. (This would

seem to follow the insights of the newly emerging generative semantics proposed by a number of linguists including Lakoff, 1971. The basic notion is that semantics is separate from and precedes syntax in accounting for language.) His work with comparative words has considerable implications for semantics. A comparative dimension consists of two opposing quality-words (for example, good and bad, hot and cold). One of these words is used as well to label the entire dimension, while the other word implies a comparison biased towards the negative. For example, "goodness" is a neutral dimension-label and "How good was the cake?" is neutral; while "How bad was the cake?" implies that the cake was not good. There is psychological support for this, such that the neutral dimension-label in a set of comparison words can be processed more quickly and remembered better. Herbert Clark has recently (1973) proposed a rather detailed interpretation of how the child's prior acquisition of perceptual categories of space and time facilitate his learning of comparative words themselves.

Eve Clark's study (1971) hypothesized that such components of relational words were acquired with age. Her subjects were groups of children of four ages ranging from 3;0 to 5;0. The dimension under investigation was relational time. Prior relations as expressed by the word "before" were considered more general ("before" being a dimension-label) and more simple; it was hypothesized that "before" could be correctly used at an earlier age. "After" was taken to represent the negation of priority, and it was hypothesized that "after" would be used correctly only at a later age than "before." The incorrect use of the words declined with age in both cases, and there were significantly fewer errors with "before" than with "after." Between lack of understanding and complete understanding of the words, there were two transitional stages. In the first transitional stage, children understood "before" but not "after." In the second transitional stage,

children interpreted "after" as though it meant "before." The general conclusion was that children learn word meanings one component or feature at a time and according to a recognizable hierarchy in some cases.

Eve Clark (1973) has further elaborated upon a general theory of semantic features acquisition. She focuses on the feature rather than the word because of a wide variety of over-extensions of word meanings by children. For example, "after" is interpreted as "before" (Clark, 1971); "less" is interpreted as "more" (Donaldson & Wales, 1970). Following the lead of Bierwisch (1967, 1970), she sees overextensions to arise from a lack of features. For instance, the features for both "before" and "after" are TIME, SIMULTANEOUS, and PRIOR. To use "after" correctly, however, one would also have to acquire the additional feature NOT PRIOR.

The approach is a stimulating one and deserves further study. At the same time, semantic features are presently only an analytic convenience. The supportive data may be alternatively explained, and the psychological validity of semantic features is an untested (and perhaps untestable) question.

Summary and Conclusions

Four approaches to word meaning and its role in human development have been explored. The similarity among the descriptions is apparent, despite the obvious variations both in wording of descriptions and in underlying theories.

Almost all of these authors talk about word meaning as having extralingual reference; some counterbalance this with a description of some word meanings as relations among words. (And some linguists talk only about relations among words.) Osgood thus made the distinction between signs and assigns. Vygotsky used a distinction between meaning and sense which does not discriminate between lingual and extralingual referents,

but rather between specific referent and general associations of a word. Olson referred clearly to perceptual knowledge of referents in the world. Riegel made the lingual/extra-lingual distinction prominent. The symbolic process as characterized by Piaget or Werner focuses on the representation of referents. Linguists have excluded reference to the world from their theories because of the apparent complexity and confusion it would introduce. If perceptual psychologists, such as Eleanor Gibson or Olson, can devise as a simple way to organize such knowledge, the psychological power of linguistic theories might well be enhanced by it.

Some have cautioned against taking word meaning as reference to extralingual objects too precisely--they argue that a word never refers to an actual concrete object, but rather to a cognitive class of objects. This was Fodor's primary criticism of behaviorism--the word as response was considered to be associated with a specific individual object as stimulus. In contrast, Vygotsky and most of the cognitive theorists see word meanings as generalizations or groupings. It would seem that both general and specific referents could constitute word meanings--whether the referents are cognitive or real objects in the world is another matter. The cognitive/real distinction may well be no more than an analytic convenience anyway. If both creativity and perception are accepted as operations upon reality, cognitive operations never occur in the absence of reality, nor is reality realized except in cognitive operations. The issue admits of no easy resolution, however, and will no doubt continue to plague theorists for a long time, perhaps as long as there are theorists.

The child develops from the lack of word meanings to their presence and increasing saliency to him. Among the behaviorists, mediation theorists allow for this, and Kendler makes it explicit. Vygotsky talked about the initial separation and gradual joining of thought and speech. The semantic conditioning studies shift from generalization

bused on sound similarity to generalization based on similarity of meaning. Both Piaget and Werner refer to the increasing importance of the symbolic process as the child develops. The syntagmatic-paradigmatic shift may be taken as indicative of an increasing precision in word use. McNeill described the word dictionary, and the Clarks talked about the gradual acquisition of semantic features.

So, regardless of theory, the consensus is that word meanings make references, either to other words or to other things or to both; that a particular word meaning refers to either an individual item or a class of items; and that word meanings develop increasing saliency to the child as he develops.

Implications for the Conduct of Inquiry

The topic of word meaning in human development has suffered from unnecessary contentiousness because sincere individuals have been unwilling to listen to each other. Theories are constructed without sufficient attention to finding shared words for shared meanings. For instance, it is difficult, perhaps impossible, to determine the difference between the phenomena described by behaviorist mediational theories and cognitive theories with regard to word meaning. Yet differences in language contribute to strongly felt convictions by some that these are radically different theories (Berlyne is a notable exception).

The root problem is in fact one of word meanings. Objects or referents cannot of themselves unambiguously specify a word or words to represent them. But theorists should agree to call the same phenomenon by the same name. There are a number of reasons why this does not always hold true; two of them will be elaborated here.

The first reason is the lack of reliability in perception. Two perceivers can hardly ever be certain that they are perceiving the same phenomenon. They may focus on

different aspects or attend at different levels or at different moments. Even a controlled environment, from which scientists often draw inferences, can only partially stabilize reliability of perception. And human activities are almost always complex, permitting a variety of perceptions.

The second reason why word meanings differ with individuals is the idiosyncratic or private nature of the brain as a theory-building instrument. Theory-building is ultimately a private process. A theorist may choose to inform himself about other theories, but unquestioned acceptance of another theory is rare. People who totally accept other theories do not invent their own.

Psychological theorists and researchers could do themselves a double service by addressing themselves to such concerns about word meanings. They could both advance psychological knowledge and contribute greatly to communication both within and about their discipline.

Other Implications for Research

A number of directions for research have been suggested throughout these pages. Several general themes will be mentioned here.

A sometimes overlooked area for empirical research concerns the psychological reality of language use as suggested by linguistic theories. The presumption is too often glibly made that linguistic constructions such as deep and surface structure do in fact correspond to psychological activities. But current linguistic theories deal with the generation of a whole sentence without regard for the sequential occurrence of the words within it. Yet it is a common experience (which surely admits of more rigorous empirical verification) that a person often begins a sentence, especially a complex one, without a focus on the words with which it will end. This "focus," whatever it is, is the very heart

of the language generation process, yet it remains untreated in theories of generative transformational grammar. Behaviorism offers a partial explanation of it with the rules of association. But, as previously stated, association narrows the range of words perhaps, but does not specify the relationships according to which a particular word is chosen. It may be that language generation is best explained by some combination of behaviorist and linguistic-cognitive rules, acting together to both produce alternative words and reduce these alternatives to the words overtly generated. Complex hypotheses combining these approaches might easily be tested.

It is important to consider simultaneously the various levels of semantic size: phoneme, morpheme, word, sentence, lingual and extralingual context are all carriers of some sort of meaning. Frankl (1959) even spoke of the quest for the ultimate meaning of one's life. Werner & Kaplan (1950) did study the effect of sentential context on the meanings attributed to novel words, but little else has been done, perhaps because it is difficult to operationalize the concepts involved. When carriers of meaning are expanded or reduced in size, one set of carriers must be substituted for another set, and the problem of reliability inevitably arises. For example, imagine the variation in responses to a request to summarize in a paragraph the Constitution of the United States.

Other questions raised by semantic size involve the size and locus of the most useful units of meaning, regardless of its carriers. Such units of meaning may reside outside the organism as some or all of a stimulus situation. Or they may reside in the interaction of the organism arriving at meanings in the environment through cognitive processes. Anglin (1970), Eve Clark (1973), and others (see Slobin, 1971) have offered candidates for units of meaning in this latter, cognitive interpretation. Anglin (1970) supports word meanings as the most useful units. His work suggests a second most important size of meanings in

associative word groupings, more abstract than the words themselves. These word groupings become more precise and reliable in the course of development (Vygotsky, 1962). Eve Clark (1973) has proposed instead that semantic features, parts of word meanings, are the most useful units of meaning. This is certainly true in a limited sense: knowing that "watch" means the same as "observe" does not necessarily indicate that one knows that "watch" means the same as "timepiece." The question is whether such distinctions are basic or marginal. As mentioned above, various levels of semantic size should be considered at the same time; the issue here is which is most useful.

The notion of semantic size implies a question for human development: as a person develops, can he handle units of larger semantic size or more units of the same size more quickly and accurately? And a corollary, how does quantity relate to meaning? Is meaning reducible to so many bits of information or to number of relationships or is it perhaps not quantifiable at all? Human development would seem to be a most acceptable crucible for the measure of such questions.

Implications for Education

In order to consider implications of approaches to word meaning for education, it is first necessary to consider two major issues in education not dealt with thus far in this review.

The first issue is that of control of the child versus autonomy for the child. Educational theories typically include strong statements about the relative importance of autonomy or control. A complete delineation of positions on the continuum is out of place here. The point is that this dimension is largely independent of the theories of word meaning as defined in this review, and any theory can be implemented in education with a wide range of combinations of autonomy and control.

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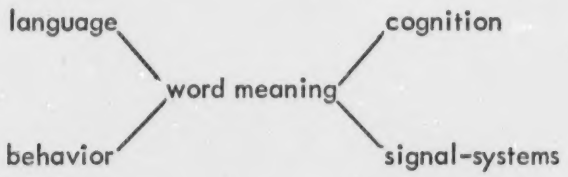
One apparent exception to this principle is behaviorism. Because of Skinner's recent (1971) pronouncements on the superfluity of talk about freedom, it might be thought that behaviorism has to be identified with control by the teacher. But behaviorism is properly no more than an approach to scientific description--it could be used to describe individuals controlling their own behavior; many people would call that autonomy.

Another apparent exception to the independence of autonomy/control from theories of word meaning is Piaget's belief that the child should be allowed to develop without innappropriate interference by adults, e.g. attempting to accelerate development. Nevertheless, Piaget's theory has been used to justify varying degrees and types of intervention in a child's development. At any rate, the issue of intervention is here considered peripheral to Piaget's theory of word meaning.

The second issue in relating this review to education is the question of the role which those responsible for education should adopt towards existing knowledge, especially towards domains such as word meaning, where there are various approaches which sometimes conflict. To this author, intellectual dogmatism and narrowness are always out of place, for scientist or educator. But the question of how to reconcile the four approaches to word meaning remains.

Consider the following diagram:



One working hypothesis, at least, is that all four approaches delineate some segment of useful knowledge about word meaning. Conflicts and overlaps, such as that between behavior and cognition, can be seen as signs of healthy scientific growth. This

analysis suggests that each approach has educational implications of worth.

The approaches will be considered in turn--behaviorist, signal-systems, cognitive, linguistic--for their realized or potential implications for education. In each approach, education will be divided into three areas: early education (pre-reading), later education (involving reading), and testing.

Behaviorism

One realized implication of behaviorism for early education is the DISTAR language program (Bereiter & Englemann, 1966). This program for disadvantaged children is based on the assumption that their greatest need is for more precise and varied language to interpret their environment. Thus specific program objectives include students acquiring word meanings for polar opposites, colors, numbers, letters, and various function words. They are also to learn to name instances of classes. These objectives seem to clash somewhat with the developmental shift in the ability to form classes that occurs between 5 and 7 years of age, at the end of the program. If it is so that before the shift children's classes are changing and unstable (Vygotsky, 1962; Kendler, 1963), then many of DISTAR's objectives seem inappropriate.

More general applications of behaviorism to both early and later education are the technologies of behavior modification and programmed instruction. These technologies relate to word meaning primarily in their principle of pinpointing and specifying the precise associations which are to be learned. This emphasis without alteration could easily exclude any systematic attention to the broader sense of words, in Vygotsky's phrase. Ironically, such an emphasis takes little account of one's ability to respond in the free association paradigm (and its derivative, the semantic differential) that has long served as a principal measure of meaning in the behaviorist approach. Free association shall be

considered more fully in the discussion of testing in behaviorism.

A behaviorist-like approach exerts influence on reading education today, taking a detour through the old structural linguistics of Bloomfield (1933). Chall (1969) outlines the controversy as follows. The consensus on the teaching of reading in the 1930's involved a concentration on word meaning--children should begin to read with meaningful words and stories which they could comprehend. Bloomfield countered that children already knew meanings from spoken language. Their specific problem in learning to read was in deciphering the written code, in acquiring the alphabetic habit. Thus what they must learn is phonics--phoneme-grapheme correspondences. More important than meaning to the child is regularity of some word spellings amid the chaotic irregularity of English spelling. Although this has been styled the linguistic approach to reading, its precise functional analysis and disregard for the whole is more characteristic of behaviorism than it is of current linguistics or psycholinguistics.

It may be said that the only test involving a theoretical approach to word meaning has a behaviorist base--specifically, the mediational theory of Osgood (1952). That test is the Illinois Test of Psycholinguistic Abilities (ITPA-McCarthy & Kirk, 1963). The ITPA was generated from an analysis of various channels of communication, levels of organization, and processes (decoding, encoding, and association). It is appropriately used in connection with behaviorist programs like DISTAR. Its use with other approaches to language education would seem more a matter of convenience than compelling logic.

It would be interesting to further explore the uses of free association as a cognitive assessement technique (it has of course been used extensively for attitudinal measurement). Johnson (1971) has presented intriguing data on the differential clustering of key terms in a subject-matter as a result of instruction. Such a technique

could be very important for use with young children if, as Vygotsky (1962) claims, the general sense of words is not always accompanied by precise meanings. Regardless of age of testees, it would be desirable to provide more than one "correct" response for a word response on tests of word meaning. A single correct response for a word meaning implies a much simpler situation than research indicates to be the case. For example, Rosch (1973) has shown that there are gradations in instances of a concept, some instances being better than others, some instances being ambiguous. Such a finding has a practical import for word meaning not matched in most testing situations.

Signal Systems

The realized implications of signal-systems for education are difficult to learn since those who take the approach are mostly Russians. However, the potential implications for education of Vygotsky's description of the development of concepts and Luria's description of the verbal regulation of behavior are straightforward.

In early education, (before age 5 or 6) according to Vygotsky, children form heaps or complexes rather than concepts with a single principle of organization. Hence an adult teacher should exhibit considerable patience and flexibility in interacting with young children on cognitive tasks. Likewise, such patience and flexibility is needed in setting limits for young children, first, before they can respond appropriately to the word "no;" secondly, before they can verbally control their own behavior (Luria, 1960). (A certain one-year-old known by the author smilingly chants "na-na, na-na" as he pursues a forbidden object.)

Cognitive Approach

The cognitive approach, especially that of Piaget, is currently the most popular foundation for early education. Among the programs based on Piaget's theory is

that of Weikart (Silverman & Weikart, 1974). What is important here is how the cognitive approach to word meaning in human development determines the content of early education. Two phenomena described by Piaget and others are of particular importance: egocentrism and the gradual development of the semiotic function towards abstraction.

As mentioned before, egocentrism may be seen as a description of the motivations in the acquisition and use of word meanings by a young child. A young child learns and uses those word meanings that fit into his own experience and view of the world. Thus a child's expansion of vocabulary (words and their meanings) cannot be arbitrary, but must interpret and relate to his experience.

When a child is young, he cannot yet deal with mental representations, according to Piaget & Inhelder (1969). As Lewis (1937) states, the child's words are part of his concrete experience; he is unable to abstract--to draw away--from that experience. Thus, in the words of Pflaum (1974), "In the language process of acquiring a fixed meaning for a word, one must have a multitude of experiences with that word. For adults these experiences need not be direct; for young children, they must be direct [p.38]." Pflaum also suggests that the opposite of this is also true--that experiences are most valuable when accompanied by verbal interpretation and refinement. This fits in with Olson's (1970) idea that words further delineate or discriminate among the elements of an experience.

Some of these same ideas have been a part of the meaning approach to the teaching of reading in education for almost half a century (Chall, 1967). As mentioned above, one takes the meaning approach by starting with meaningful reading of whole words, sentences, and stories relevant to the reader. Picture-word associations are valued over grapheme-phoneme correspondences--phonics. It is desirable to teach phonics, but

incidentally, in the course of reading a story. A good current example of such an approach is the Macmillan Reading Program (Harris & Clark, 1970). This program is particularly noteworthy in its inclusion of stories which appear to mesh well with the experiences of children in modern urban areas. It is curious that the authors list their first goal for the program as decoding when their meaning approach is so abundantly obvious.

As regards testing, cognitive theorists have offered salient criticisms of traditional psychometric techniques without as yet providing any widely available substitute techniques or standardized tests. (It should be mentioned that Pinard & Laurendeau, 1964, as well as many others have developed Piagetian tests for research purposes--the point is that these tests are not suited for wide usage.) The criticisms of cognitive theorists however, are worthy of consideration, particularly as they regard the testing of word meaning.

Consider what Piaget has said about intelligence testing (1947). He regards such testing as reducing a variety of complex operations to a meaningless number--all the worse since this number is derived from the chronological age of the individual, and people mature at different rates. As Pinard and Laurendeau (1964) interpret Piaget, an intelligence test tells nothing about the character of intelligence, blindly evaluates intelligence rather than diagnosing it. Now consider as an example the Peabody Picture Vocabulary Test (PPVT--Dunn, 1965), reputed to be a measure of verbal intelligence. The procedure is the same for all items--the tester says a word and the testee points or otherwise indicates one of four pictures which is supposed to represent the same meaning as the spoken word. A correct response does indicate that a testee knows the meaning of a word, at least in one sense. But what does an incorrect response indicate? More likely a lack of experience than a lack of intelligence. Also, if intelligence involves progressive

abstraction, a series of words with equally concrete referents can do little to assess it. It would make more sense to test the controlled acquisition of word meanings (a) under antecedent conditions common to all testees and (b) in a greater variety of ways (use in sentences, recall, free association, etc.). The construct validity of the PPVT has been evaluated by correlating it with other intelligence tests. This clearly does not come to grips with Piaget's criticism. From a cognitive point of view, most standardized tests of intelligence simply have no construct validity--they do not measure the psychological attribute which they claim to measure.

Linguistic Approach

Current linguistic and psycholinguistic implications for education, in this author's opinion, are potentially of radical importance, especially as compared with what has actually been done. But it is difficult to overestimate the extent as well as the importance of the problems. If Chomsky's approach only suggested a reformulation of reading and language curricula, that would be enough. But there is inherent in Chomsky's transformational grammar an alternative theory of the relation between human cognition and human behavior--and that is central to all education.

Oppose to this rather grand conception the current poverty of linguistics and psycholinguistics applied to education. Representatives of these fields may occasionally be hired as consultants to edit texts written by someone else. What is needed is the full pursuit of the endeavor of application in a way analogous to the application of Piaget's theory to early education.

In the meantime, the work of McNeill (1970) and Eve Clark (1971, 1973) is of some utility to educators as a description and interpretation of the development of word meaning. In fact, teachers of young children might find it of interest to be on the watch

for overextensions of word meaning. Asking the child probing questions about the meaning of a word in such an instance could be mutually informative to teacher and child.

General Considerations

Finally, Pflaum (1974) has provided an example of an amalgamation of approaches applied to education that represents a good use of theories in practice. Her general premises are, first, that the child needs to expand his listening and speaking vocabularies through experiences planned by a teacher or parent. Thus it is necessary to provide the child with a rich and varied environment. Second, the effects of the environment must be augmented through the interactive involvement of the child with objects, people, actions, and pictures. These interactions should involve naming, describing, classifying, explaining, and communicating. Thus adults should (a) name things and events for children; (b) plan activities for children which encourage them to add new word meanings to the ones they already use and to examine and extend all of the word meanings they use; and (c) prompt and probe children to use and refine their word meanings.

The focus of the theories presented throughout has been descriptive rather than prescriptive. It might be a desirable change to be less prescriptive in the schools as well, to adopt a more scientific, hypothetical approach to what constitutes valuable learning. The schools are frequently criticized these days for their irrelevance to life outside the schools. The fundamental solution to that irrelevance is to preserve more of non-school life inside the schools. In the case of children's language, that end is accomplished simply by a teacher listening as well as talking to children; and by encouraging their spontaneous expression of thoughts and their freedom from narrow beliefs about the role of a student. The teacher has as much to learn as the child.

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The implications for research and educational practice presented here would require considerable work to implement. In light of this review, they seem sensible implications. But, after all, the study of word meaning is a way of studying human understanding. In the words of Vygotsky (1962). "A word is a microcosm of human consciousness [p. 153]." As such, one's motivation to study word meaning, one's expectations for the value of such study, are closely related to one's expectations for the potential of human understanding. That potential may well be limitless.

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